DOCUMENT RESUME

ED 200 094 HE 013 559

AUTHOR Manus, Lee Aura; Zipser, Dean
TITLE Patterns of Problem Solving and Its Peer Teaching Program: An Interdisciplinary Innovation.
INSTITUTION California Univ., Los Angeles. School of Engineering and Applied Science.
PUB DATE 77
NOTE 7p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Communication (Thought Transfer); Computer Oriented Programs; Computers; *Course Descriptions; *Decision Making; *Graduate Study; Higher Education; *Interdisciplinary Approach; Language Role; Learning Experience; Mathematical Models; Models; *Peer Teaching; Probability; *Problem Solving; Programing; Undergraduate Study
IDENTIFIERS *University of California Los Angeles

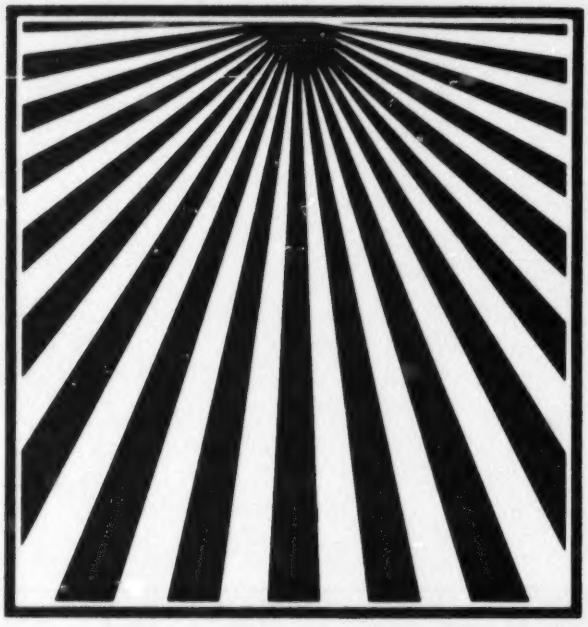
ABSTRACT

An interdisciplinary course in problem solving, entitled "patterns of problem solving," and its unique peer program offered at the University of California, Los Angeles, are described. The esphasis in the subject matter and approach is to expose the student to the wide range of alternative problem solving techniques and to enable the student to use these methods in practical applications. The subjects and coverage are in large part dependent upon the instructor's prerogative. The 10 chapters of a text entitled "Patterns of Problem Solving," which was developed by Moshe F. Rubinstein specifically for the course, are outlined. The chapters cover numercus theories, methods, and procedures, including probability theory, the general process of constructing models, and the development of models for decision-making, optimization, and simulation of dynamic systems. The text is directed to the advanced undergraduate, graduate, or professional. A brief history of the development of the course is presented that notes that the course was introduced in 1969 and identified as Engineering 11. In 1973-74 students were used as instructors. Factors unique to Engineering 11 that resulted in the adoption of a peer program are noted, including the diverse nature of the course enrollment and the need to lessen time demands on faculty in order to attract prominent faculty members. Selection of peers, the objective of creating a good learning environment, and the use of a peer room, or lab, are described. (SW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED200094

Patterns of Problem Solving and Its Peer Teaching Program



"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Mabel F. Rubinstein

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

An Interdisciplinary Innovation
Sponsored by The School of Engineering and Applied Science
University of California, Los Angeles

Lee Aura Manus and Dean Zipser

1977

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

HE013559

LEE AURA MANUS:

A senior majoring in English, with a Creative Writing Specialization in Poetry. She completed "Patterns of Problem Solving" and its follow-up "Applied Patterns of Problem Solving" in her freshman year at UCLA, and served as a peer teacher for two years. She plans to work in instructional television, developing programs for the classroom.

DEAN ZIPSER:

A UCLA graduate in Political Science, 1977, currently attending Stanford Law School. He completed "Patterns of Problem Solving" and its follow-up course "Applied Patterns of Problem Solving" in his sophomore year at UCLA, and served as a peer teacher for two years. Upon graduation from law school, he plans to pursue his interests in law, government, and politics.

The UCLA campuswide course — "Patterns of Problem Solving," and its unique "peer program," have been the objects of numerous inquiries. This paper is designed to provide documentation which will hopefully answer several of the recurring questions directed at the creator of the course, Dr. Moshe F. Rubinstein. The authors are two peer teachers who have taken the course and have been involved in the program for the past three years. We hope you will find it helpful...

Patterns of Problem Solving: The Course

"Patterns of Problem Solving" was designed to provide a foundation for attitudes and skills productive in dealing with complex problems in the context of human values. The specific classes of problem solving techniques covered in the course have been found useful in traditional fields of endeavor. But perhaps the most significant feature is its truly interdisciplinary approach. Briefly summarized below are the ten chapters in the text, which Dr. Rubinstein developed specifically for the course, which reflects this approach:

Chapter 1: Problem Solving: culture, values and models of problem solving; difficulties, guides and attitudes.

Chapter 2: Language and Communication: from evolution of writing to computer language, symbolic representation.

Chapter 3: Computers — Fundamental Concepts: computers, their structure, their use, how they work.

Chapter 4: Probability and the Will to Doubt: information, its relevance, credibility and measurement, entropy.

Chapter 5: Models and Modeling: purpose and nature of models, models in history, behavior, science and engineering.

Chapter 6: Probabilistic Models: samples, distributions, errors of omission and commission, simulation.

Chapter 7: Decision Making Models: decision criteria, utility theory, game theory, group decision.

Chapter 8: Optimization Models — "Selecting the Best Possible:" linear and nonlinear programming, dynamic programming.

Chapter 9: Dynamic Systems Models: cybernetics, its ubiquity, history and applications; simulation of dynamic systems.

Chapter 10: Values and Models of Behavior: value judgment, social preferences, consensus, assessment of values.

The entire subject matter of the text was not intended to be taught within the span of the UCLA ten-week quarter. The subjects which are or are not taught, and the extent to which they are covered, are in large part dependent upon the instructor's prerogative. However, there do exist some areas upon which every instructor focuses. These "constants," (which comprise the major part of the text & course) include Chapters 1, 4, 5, 7, 10 and parts of Chapter 2. The material comprising Chapters 3, 6, 8 and 9 are dealt with only to the extent that each instructor desires. Often the text is not the only source of subject material. Some topics covered during the quarter are those which each instructor introduces as a result of his or her background. For instance, one instructor, also a lecturer in psychology, employs psychological models and examples during the quarter. Another instructor introduces economic models in one of his lectures.

The emphasis in the subject matter and approach is twofold: to expose the student to the wide range of alternative problem solving techniques, and to enable the student to use these methods in practical applications. A major focus is on breaking mindsets. Too often, the population at a large university, such as UCLA, tends to stratify. This course exposes the humanities student to objective tools such as numerical models, while introducing

the student in physical or life sciences to subjective notions, such as values.

The second emphasis, the practical applications of the tools, reflects both classroom and non-classroom experiences. Instructors are encouraged to employ real world examples in their lectures and homework assignments. Most instructors require the students to apply the tools they have learned to a personal problem, and this becomes the course project. Projects in the past have covered such diverse topics as choosing a major, selecting a career, buying a car, finding a place to live and designing an educational game. Though most projects are submitted in written form, some are done orally, on film or through the use of slides.

A Brief History

Dr. Rubinstein's motivation for creating this course was a result of his ten-year association with the Modern Engineering Program for Executives, for which he serves as a lecturer and director. Dr. Rubinstein began to perceive certain common elements in the subjects covered in the program and common elements throughout the University curriculum.

"Patterns of Problem Solving," identified as Engineering 11, was first introduced in Fall, 1969, with a section of 32 people. The course was taught in the fall quarters of the next two years, the enrollment growing to 60 and then 75 students. The following year (1972-73), Engineering 11 was offered in both Fall and Winter quarters with an enrollment of 50 students each quarter. Up to and including this time, Dr. Rubinstein remained the sole instructor of the course.

However, with the increasing popularity of the course, Dr. Rubinstein realized that he could no longer be Engineering 11's only instructor. To enable others to adequately teach the course, he found it necessary to consolidate the material into a textbook titled, appropriately enough, *Patterns of Problem Solving*. Concurrent with this was the development of both a teaching manual and solution guide. The 1973-74 academic year began a marked expansion in the number of students, sections offered, and instructors. Today the enrollment has reached a steady state of 12 sections per quarter — about 1500 students per year. Instructors over the years have included many distinguished individuals from many fields, including Engineering Systems, Artificial Intelligence, Reliability, Physics, Mathematics, Applied Mechanics, Computer Science, Control Theory, Relativity and Electromagnetic Theory, Psychology, Philosophy and Management.

Funding for this course has come from various sources: the School of Engineering, the Office of Undergraduate Affairs, University Innovative Grants, the Chancellor's office and the National Endowment of the Humanities.

One successful offshoot of "Patterns of Problem Solving" has been the incorporation of a short version of this course in the National Science Foundation's Chautauqua-Type Programs conducted by the American Association for the Advancement of Science.

Patterns of Problem Solving: The Peer Program

Coupled with the increasing number of professors and graduate students teaching the course, 1973-74 also ushered in a new source of instruction: the students themselves. Several factors, unique to Engineering 11, resulted in the adoption of a peer program. The diverse nature of the enrollment dictated the need for individual attention in some areas. Peer teachers would provide the opportunity to exploit the different backgrounds of the students toward various aspects of the course. In order to attract prominent faculty members as teachers, the time demands imposed upon them needed to be lessened. Because students many times find it easier to "relate" to other students than to instructors, and because the course necessarily entails the sharing of experiences through small projects, "peers" became a logical answer. A further benefit to all those involved was the possibility of more extensive feedback between instructor and student. The peer could serve as a link between the two parties — by informing the teacher of concepts which were or were not conveyed well, and by clarifying parts of the lectures to the students.

In the Fall quarter of 1974, a controlled experiment was conducted to evaluate the success of

the early peer program. Each instructor taught two sections, with peer teachers assisting in one of them. It was found that having three peers per section, roughly one peer for eight students, was highly beneficial, facilitating student mastery of the often complex material. However, continuing this ratio became difficult to maintain financially. This method also presented an additional burden to the instructors, who had to personally train their peer teachers. This was the impetus for a peer training program, which will be discussed later.

For the last three years, the peer program has stabilized in terms of the number of peers and their duties. Generally, there are two peers per section. The peers grade homework, tests and projects, and occasionally make presentations in the class. The extent of their participation in class depends upon the instructor's needs and desires. Peer teachers also put in office hours in the Peer Room (which is discussed below). The peer teachers are paid on an hourly basis with a maximum of eight hours per week for grading, attending class and working in the peer room, although they often put in a lot of extra time on their own.

The Peer Room

An integral part of the peer program is the laboratory used for office hours, which is called the "peer room." As with the peer program itself, the peer room was created with several specific and important objectives in mind to make the program and course a success. The lab is centrally located between the two rooms in which Engineering 11 is taught, to allow for easy and immediate access by the students, peers and instructors.

At present, the room consists of five large tables each with about five chairs, a couch, and seven blackboards covering three walls. The room is staffed Monday through Friday from 10 a.m. to 3 p.m., but it is usually occupied continuously from 9 a.m. to 5 p.m. The number of peers and instructors in the room at a given hour range from a minimum of two, to five or six at the peak hours. Usually, the room is also staffed by at least one instructor each hour.

It should be noted that instructors hold office hours in the lab with the peers, thus further facilitating a sense of community and downplaying any notion of a hierarchy, either formal or informal.

Perhaps the primary reason for the peer room is to maximize the effectiveness of the peers. The lab allows peers and instructors to be immediately available to help students from *any* section. Since each peer is knowledgeable about the concepts and problems in the book, he or she is able to assist any Engineering 11 student with homework problems or general concepts.

Many students naturally seek out their particular peer or instructor. This results in the creation of a certain "clientele" for the peer. However, numerous students visit the peer room at hours convenient to them which may not coincide with those of his or her peer. Since the room is staffed throughout the day, these students are still able to receive immediate attention.

With the differing backgrounds of the instructors and peers, and various sample problems, projects and examples which instructors leave in the room, the lab has also become a type of resource center. In the future, the room will house a small library, computer terminal and game center.

The peer room was not established solely as an academic center. The room is also meant to, and does, function as a social center. This is in keeping with a basic objective of Dr. Rubinstein to develop in Engineering 11 a "sense of community."

The room has become a place where students gather not only to discuss "Patterns of Problem Solving," but also to talk over concepts in "Organic Chemistry" or "Legislative Politics." People often simply come to eat their lunch before a class. The room is also visited by former Engineering 11 students who come back to talk to their old peer or instructor. The lab has yet to become the melting pot of UCLA, but it does tend to personalize an otherwise imposing and confusing campus.

Selection of Peers

Prospective peers are selected from Engineering 11 and Engineering 12 ("Applied Patterns of Problem Solving" — a more advanced course) with instructor recommendation. Obviously, qualities for which they are chosen are mastery of material and general competence. But another very important quality is personality. Peers need to like people and like helping them. They are trained not only to answer questions, but also to ask motivating questions, so that in the process, the students learn to help themselves.

Summer Training Program

After prospective peers are chosen, most go through the Summer Training Program. This is an in depth seminar also attended by a few experienced peers and instructors. Each year, the training program has become more intense, in part as a function of a shortened length resulting from the ubiquitous financial crunch. The training program serves to reinforce the material and improve teaching techniques. Participants deliver lectures and take part in simulations of experiences they might have as peers and instructors. The training program also affords them an opportunity to get better acquainted and develop a greater sense of community.

Sense of Community

The objective of creating this oft-mentioned sense of community remains a vital part of the program. To gain the greatest benefit from Engineering 11 requires both instructors and peers to regard the course as more than "just a job." A comradery between the teachers, peers and students enables each to gain from the other's experiences. Peers and instructors can more readily share techniques and advice, optimizing the teaching situation.

The meaning of a sense of community can best be summed up as an attempt to make "Patterns of Problem Solving" not just a class, but an "experience." In that way, all parties can leave the course knowing that they have learned more than just concepts in a textbook; they have also learned from each other.

In order to create this situation, a good relationship must be established between the peers and instructors. Aside from simply learning of each other's strengths and weaknesses, peers and instructors must be able to relate to each other and to the students on a more personal level. As the course serves to consolidate concepts from the different academic disciplines, a sense of community brings greater understanding between people of divergent backgrounds.

Though its benefits are many times seen in the academic aspect of the course, a sense of community has been implemented in large part through non-academic measures. Each quarter, all the instructors and peers gather at Dr. Rubinstein's home to share experiences over coffee and cake. This has led to an occasional party for peers, instructors and friends. Engineering 11 personnel can also be recognized by a new addition to the "Patterns of Problem Solving" paraphernalia: colored T-shirts displaying the cover of the textbook. Several peers and instructors also participated in a coed intramural football team (which, we might add, was undefeated until its opponents began showing up for the games). The Engineering 11 students are not exempt from this sense of community. The peer room now has a Log Book to which any and all are encouraged to contribute various words of wisdom. Finally, the story of this sense of community would not be complete without the mention of a most unforeseen consequence: romance. It has already resulted in one marriage, an ongoing two-year romance, as well as the usual number of dates, infatuations and disappointments.

Conclusion

Upon reflection, we feel that "Patterns of Problem Solving" has indeed established itself as a unique program. Much of what the course has set out to accomplish, it has; much still needs to be done. The continuously rising enrollment figures speak for themselves. The knowledge gained through Engineering 11 is helpful in several other academic areas. Most students leave the class with the feeling that they *did* learn something they consider valuable.

But it is more than just the content of the course that makes Engineering 11 what it is. Attempts at creating an "esprit de corps" have been extremely successful, and perhaps too successful. A formal hierarchy does not exist, and because of that we often can poke fun at ourselves. We would like to close by relating the words which a former instructor, Ben Rodilitz, spoke to his class regarding the relationship between the Engineering 11 students, himself, Gary Gasca (the course coordinator and one of its instructors) and Dr. Rubinstein (M.F.R.). Ben explained that all the parties are considered equal, and to illustrate this, he wrote the names on the board in a line:

STUDENTS — BEN — GARY — M.F.R.

However, after examining this for a few seconds, he made one slight alteration, and left the diagram as follows:

STUDENTS — BEN — GARY — M.F.R.